AduLeT
Advanced use of Learning Technologies in Higher Education

Co-funded by the Erasmus+ Programme of the European Union

AduLeT - Advanced Use of Learning Technologies in Higher Education

Recommendations & Strategies for Technology-Enhanced Learning (TEL)

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Table of content

1 INTRODUCTION

The AduLeT (Advanced Use of Learning Technologies in Higher Education) project sought to support higher education (HE) lecturers in technology-enhanced learning (TEL) via the community of practice approach to equip and to empower HE lecturers with TEL methods, TEL tools and best practices. Hence, one of the first initial research action plans was to investigate the current status of TEL in HE and barriers to adoption for HE in Europe.

This document first provides an overview of the findings of the barriers identified in the GCM study across higher education institutions in the European context. Next, it provides recommendations and strategies for each cluster of barriers identified. Finally, the top cluster solutions for each participating country will be presented and discussed with authentic examples.

Strategies and Support for TEL

The case studies presented represent only an application example of some of the most currently used TEL tools. In all of them, the same guidelines have been followed to homogenize the content. In this way, although it is not immediately obvious, the format of each example includes first the name of the TEL Tool and the context in which it is applied; then there is a brief reference to where the example comes from (authors); thirdly, the target groups to which the example is addressed appear; a small justification follows on the use of that tool; fifth, a general description of the context and how to apply the tool is included; towards the end, a section is included displaying practical results of the use of that tool; and finally there is a comment on the weaknesses or problems that can be found in the use of that tool.

The objective of developing the content of these examples, as described above, is to offer the reader a practical guide to the use of several current tools developed by working groups of

the AduLeT project, according to what has been agreed. This guide aims to offer the users all the possible precision when adapting the tool to their needs.

We have included very practical examples of application which can be found in the everyday higher education teaching context. That is, we have placed ourselves on the position of a user who usually has little time to experiment new tools. We have done it emphatically to try to provide real solutions to the barriers found by higher education teaching staff when using the TEL Tools, which we have described in one of the input boxes on the platform of our Community of Practice (CoP). From there, it also allows the search for solutions based on the selection of the barriers that are known and applicable to our case.

The application of a particular tool to a practical case always entails a personal touch of the teacher who uses it. Therefore, in the descriptions that we present as examples of application, the subjectivity of the lecturer who applies it should be interpreted as one of the multiple options presented by the tool. Obviously, each user must adapt it minimally to his teaching environment and to his students' learning styles.

Among the examples presented, there are those that describe global tools that may not seem to fit in this section, or that we did not properly imagine them as tools. However, what needs to be highlighted is that their use in the context presented does solve some of the problems or barriers that are mentioned in the platform's start list (CoP). The concrete use of any of these global tools makes them powerful tools to enhance the learning of our students. It is the way in which the tool is applied that distinguishes it and makes it especially suitable for the function that the teacher envisages.

The adequate use of the TEL Tools provides the lecturer with an instrument of great motivation for students. At the same time, it involves them in an active way and with much more concentration than what it would mean to attend a class as passive elements to listen to the explanations given by the teacher, or to see how and what he writes on the blackboard: repeated endless formulas or theoretical information. These might be difficult to understand by the teacher's own handwriting or by possible mistakes that we, as teachers, can make when writing.

It is also worth noting that the use of TEL Tools provides the student with extra data information that, in a different context, would otherwise be much harder to obtain. Think, for example, of simulation programmes, which is one of the tools that can be found in the repository of the initial table of TOOLS. A simulator program of electrical and electronic circuits such as YENKA (formerly known as "Crocodile Clips") shows in graphic mode the electrical circuit that the student is building, whether working individually or in groups. Once the circuit is built, the student places a series of meters, such as voltmeters, ammeters, wattmeters, etc., which will provide the actual measurements that the circuit would be generating if it were actually set, but with the tremendous ease of varying a parameter in one of the elements of the circuit and, automatically, the consequent variations that are recorded in the measuring devices appear.

If we imagine the implementation of this practice in a conventional way – assembling the circuit, soldering the components, connecting the measuring devices,… - we would have serious space problems, because each student would need a large table for himself and the circuit he is designing. To this we must add that if each student acted individually, he would need all the components and measuring devices for his circuit. How many measuring devices can a classroom have available to students?

It is unthinkable today that the practices are performed physically because of economic cost, facilities and waste of material. However, until the appearance of the TEL Tools this was how it was taught in a practical way in vocational schools and engineering schools.

The TEL Tools have given autonomy to each teacher to design their teaching strategy with their students, because they allow all the flexibility and economy that we did not enjoy before their appearance. They are, therefore, inexcusable elements of use by any teacher, and essential for student learning. Nonetheless, it is necessary, as demonstrated by our project AduLeT, that the higher education teaching staff have a number of facilities that enable them to find the most appropriate tools to facilitate their day-to-day teaching, without having to select and use the most appropriate tools for their teaching practice almost on their own or in a particular way.

What AduLeT offers to its users are strategies and support so that they enhance their teaching practice to levels of maximum efficiency, providing solutions to their day-to-day needs.

2 METHODOLOGY

Research Design & Sample

The Group Concept Mapping (GCM) was used to capture and analyse the challenges and barriers in technology-enhanced learning (TEL) for the higher education (HE) in Europe, GCM affords a structured participative approach to facilitate groups of experts to arrive at a consensus on a particular issue. The multi-step approach includes a number of simple and intuitive activities such as idea generation at the brainstorming phase, followed by sorting and rating of ideas. The brainstorming focus statement was: "A challenge and/or opportunity for technology-enhanced teaching and learning in my university is …". After the generation of ideas in the brainstorming phase, sorting and rating of the ideas. Participants first sorted the ideas by means of grouping them based on similar meanings and providing a group name to these similar ideas. Finally, participants had to rate the ideas based on i) importance level; and ii) easy to solve level. For the importance level about the problems using ICT in HE, participants used a scale ranging from 1 (relatively unimportant) to 5 (very important) and for the rating each of statement on how difficult /easy it is to solve the problem about using ICT in teaching, participants used a scale ranging from 1 (very difficult) to 5 (very easy).

Forty-nine teachers participated in the brainstorming phase of the GCM studyout of which, twenty-eight took part in the second phase, i.e., sorting and rating of the statements on challenges in TEL. Represented across Europe were teachers from Finland (3.6%), Germany (14.3%), Hungary (25%), Netherlands (17.9%), Portugal (17.9%) and Spain (21.4%). The dominant teaching mode was face-to-face (67.9%), followed by online (17.9%), and blended learning (14.2%). The perceived level of expertise of using ICT in teaching: 'beginners' (14.3%), 'advanced' (57.1%) and 'expert' (28.6%). The participants came from diverse educational

background: educational science (47.1%), computer science (17.6%), social science (14.7%), others (20.6%).

3 BARRIERS TO TECHNOLOGY-ENHANCED LEARNING IN HIGHER EDUCATION

Multidimensional scaling (MDS) and hierarchical cluster analysis (HCA) was applied to capture patterns and trends in the data (For a detailed description of the MDS and HCA, refer to Jokiaho, May, Specht, & Stoyanov, 2018). A six-cluster solution framing the critical barriers in TEL was eventually identified:

1. Lack of organization support;
2. Teachers' lack of knowledge and skills;
3. Lack of time;
4. Lack of hardware and software;
5. Students' lack of knowledge, skills and motivation; &
6. Lack of reward & recognition.

Some examples of statements in the clusters are:

- LACK OF ORGANIZATIONAL SUPPORT ("40. Small amount of support available and/or you need to be very active yourself in order to get the needed support for planning, organizing and completing online courses", "51. Support is needed to overcome difficulties to achieve excellence in the use of information for learning and research", and "68. I have no or too little support with ICT problems that occur suddenly");

- tEACHERS' LACK OF KNOWLEDGE AND SKILLS ("31. I am afraid of making mistakes in front of the class", "41. I do not know well the methodology of using ICT in a language classroom", and "64. Not knowing the most appropriate educational technology);

- LACK OF TIME ("2. Lack of time to know how tools work in real-life (classroom)", "65. The time needed to get to know the tools available with the pressing needs to teach now and not after I have mastered the tool", and "67. The lack of time for preparation");

- LACK OF HARDWARE AND SOFTWARE ("10. I have to buy licenses to all my students to teach", "25. The lack of proper equipment or software", and "74. Teachers and students have different devices: teachers have Macbooks and students have Chromebooks";

- sTUDENTS' LACK OF KNOWLEDGE, SKILLS AND MOTIVATION ("45. I am afraid of unsatisfied students that will complain if things fail by ICT", "77. Heterogeneous learners: I have to modify every content for new groups even if the subject (topic, content) is the same", and "83. Some students do not yet have the competencies to use ICT in an educational setting, they have to learn them first"); and

- LACK OF REWARD AND RECOGNITION ("12. There are no rewards for better teaching, so why go through the trouble of creating something new?", "28. Quality of ICT is not part of the internal teacher evaluation", and "87. I do not get rewarded for my efforts but it will take me more hours").

The statements and their rated importance and feasibility differ depending on the participating country, this also hints to subtle sometimes important differences between the perception and also necessary actions in the different partner countries.

4 RECOMMENDATIONS AND STRATEGIES FOR TEL

In this section, we first provide an overview of the six clusters solution before presenting the national solutions specific to each of the participating countries in the GCM. Support at the institutional level is instrument to foster TEL in HE. Most of the recommended solutions and strategies has significant implications on the staff management and support system as well as the IT infrastructure provisions at the organizational level.

1. LACK OF ORGANIZATION SUPPORT

- The management of the complexity of tools should fall under the realm of the administration instead of the users. Long term tools are preferred and organizational support, in particular, for blended learning is pivotal. While the lack of organization support is not rated high on importance it is under the top clusters considering the easy/difficult to solve dimensions. This gives opportunity for action and is perceived as a solvable challenge. Considering the statements highlighted in the analysis infrastructural embedding of ICT support for teaching as also competence development in advance and in “secure” environments and training situations that do not confront teachers with real world teaching situations and the challenge of mastering a new technology are seen as important activities.

2. TEACHERS’ LACK OF KNOWLEDGE AND SKILLS

- Motivational tools for lecturers are recommended and internal experts to render staff support, e.g., providing documentation on know-hows e.g., structuring of content in TEL lessons. This is also seen as an opportunity for developing shared knowledge between educators in knowledge and training networks.

- A centralized, one-stop support platform to connect lecturers and core stakeholders/community of learners. This would enable the teachers to learn about ICT tools and methods for specific educational settings and instructional designs they

make use of. Also starting from specific tools and learning about their opportunities is a starting point for teacher driven innovation and creativity in teaching.

3. LACK OF TIME

- "Paid" time for sharing of expertise and resources, training in the use of tools, documentation and preparation of TEL lessons could be considered as incentive. In most cases teacher need to prepare for using new and innovative methods in their spare time, models as teaching fellowships that enable dedicated time to renewal and innovation of course and teaching material are highly appreciated.

- The onus to solve the issue of time should fall on both the individuals as well as the organization.

- To overcome the impasse of time preparation required for TEL lessons: more support could be rendered at the beginning phase for lecturers new or still novice to TEL methods, tools and best practices: support could come in the form of e.g, crash courses, all in one e-TEL handbooks, TEL resource bank/ repository.

4. LACK OF HARDWARE AND SOFTWARE

- Organizational support in terms of IT infrastructure and documented best practices should not constrain the creativity and innovative approach of teachers.

- Initialization of a "think tank" of experienced TEL Lecturers and IT support staff to procure current and emerging TEL software would stimulate and enable the usage and experimentation with new media tools.

5. STUDENTS' LACK OF KNOWLEDGE, SKILLS AND MOTIVATION

- To increase student readiness for TEL: engage students in creative, complex and challenging problem-solving learning scenario so that they are better able to identify themselves with these barriers and solutioning process – get them to pitch their ideas

6. LACK OF REWARD AND RECOGNITION

- Nurture student experts in TEL
- Invest in ICT teaching: train the trainer approach.

Following are solutions and strategies peculiar to each of the participating countries:

4.1 FINLAND

Solutions and strategies to national barriers to TEL

LACK OF REWARD AND RECOGNITION

Lack of appreciation can be seen as a lack of reward: there is no motivation to do better when it has no effect. Or, if the staff members' attitude toward management has deteriorated, one might think the work done (teaching etc) doesn't matter: Especially when you notice lack of interest to quality education this is directly reflected back to work This is also reflected in the lack of resources to design and implement new and existing online courses and content. See: Lack of Time also. At the level of strategy, digitalisation and digital campus are our goals but how do they convey to our workspace?

Solutions:

1. Creating a workable and equitable incentive system

2. Caring for the well-being of employees

TEACHERS' LACK OF KNOWLEDGE AND SKILLS

This section reflects the rapid change from traditional "classroom" teaching to online coaching: The pedagogy, new tools and methods have to be taken hold of quickly along with

all the other TEL related skills. Teachers do not have the time or the knowledge to take everything new to the extent that the speed of change would require.

Solutions:

1. Provide support for the introduction of new tools and pedagogical solutions. These include: instructions and guide videos, but also provide training for the teachers along with digimentoring system.

2. Provide clear information on what tools and methods are available and should be introduced. The services on offer are clear and easy to use, tested and configured to suit your needs.

LACK OF TIME

The lack of time for the reasons stated before one is perhaps the biggest obstacle to using TEL. The great amount of work and the mismatch between the resources available to do it is apparent. Lack of time is also conveyed as a congestive load, and if a person is heavily burdened learning new skills required for TEL and taking hold of new tools and methods becomes difficult.

Solutions:

1. Reduce unnecessary bureaucracy and simplify operations and thus save resources.

2. Distribute tasks so that the resources of the teaching staff do not go require (unnecessary) administrative or other chores.

3. Reassign, divide and modify tasks to reduce cognitive load.

4. Gain more resources through fundraising, on-sale services, and developing own service production (including teaching) to provide more resources.

5. Reduce costs by shifting teaching more to the network, reducing rental costs.

LACK OF HARDWARE AND SOFTWARE

The point is perhaps the least relevant to the issues raised by Humak. Systems and technical solutions for implementing e-learning exist. The problems that can fall into this category are mainly informative: what, when and how. See. Lack of Knowledge and skill.

STUDENTS' LACK OF KNOWLEDGE, SKILLS AND MOTIVATION

Helping students create clear professional self-esteem and identity is important. Students who have been selected for the online degree (and mixed mode programs) are generally very motivated. The problem comes when students are so called day students waiting for “teaching”, schedules and prearranged studies in general.

Solutions:

1. Increase the sense of cohesiveness, self-esteem and success etc. of students.

2. Increase student competence by introducing the teaching of tools and solutions that are important for study and working life.

3. Develop further the digital tutoring system.

4. Provide adequate introduction to new cohorts about the applications available to the institution, etc.

LACK OF ORGANIZATIONAL SUPPORT

The lack of support from the institution is partly related to the scarcity of resources and strategic choices as to how TEL can be seen in the service offering: it has been decided to take certain strategic choices and to select certain technical solutions, but their impact on other educational functionalities is not necessarily clarified.

Solutions:

1. Add a dialogue inhouse about what we are doing and how and adjust the work accordingly.

2. Make informed choices that best serve TEL.

3. Introduce expertise within the whole university when making decisions, making the entire organization involved.

4.2 GERMANY

Solutions and strategies to national barriers to TEL

The barriers for the implementation of ICT in higher education of Germany as suggested by hierarchical cluster analysis contains seven cluster that can be divided in two bigger areas. On one hand there are four clusters including barriers that are related to teacher's are student's skills and attitude towards ICT. On the other hand there three clusters with barriers related to technology. Each barrier will be shortly introduced followed by recommendations how to overcome these barriers.

LACK OF TIME

Studies have shown that teachers in higher education consider lack of time as a main barrier for not using Technology Enhanced Learning (TEL) (Jokiaho & May, 2017; Jokiaho, May, Stoyanov & Specht, 2018). The additional time needed for preparation takes time, but also to get go know tools and to evolve ideas how to use tools within a specific setting.

In fact, almost every federal state in Germany have regulations concerning the teaching load, which also involves the crediting of digital courses. If teachers choose to teach in blended learning courses or online courses, the implementation and support of these courses is counted on the teaching load (Lungershausen, Emunds, & Buß, 2016). However, most of the

teachers in higher educations do not seem know about these regulations. An easy way to overcome this barrier would be to inform teachers at the own university. Furthermore, this possibility should be issued at trainings related to implementation of blended learning courses or online courses.

TEACHER'S LACK OF KNOWLEDGE AND ICT SKILLS

This clusters includes statements referring the knowledge and ICT skills of higher education teachers, such as not knowing which is the most appropriate tools in a specific setting. This barrier could be overcome by offering the needed support and trainings at the own institution. The prerequisite for this, however, is that the teachers have the required time for improving their knowledge and ICT skills.

On a national level initiatives can be found that promotes the meaning of digitalisation and ICT skills in general. For instance Hochschulforum Digitalisierung is an independent national platform since 2014 that supports universities "in making digitalisation an integral part of their institutional strategy and in incorporating it in their teaching activities" (Hochschulforum Digitalisierung, 2019). Furthermore, Hochschulforum Digitalisierung offers a network with that aims higher education teachers to exchange experiences and build skills in digital teaching and learning issues.

STUDENT'S LACK OF KNOWLEDGE AND SKILLS

At the first sight it might be surprising that the so called "net generation" have a lack of knowledge and skills concerning the use of tools and ICT. A recent representative study in Germany show that not all students are "Digital Natives". Not everyone can use digital media for learning processes (Schmid, Goertz, Radomski, Thom, & Behrens, 2017).

A way of overcoming this barrier is to provide good examples for the use of TEL in courses by the higher education teachers. The prerequisite for this, however, is that the teachers have

the required knowledge and ICT skills. Furthermore, universities could provide specific courses in general.

STUDENT'S ATTITUDE TOWARDS ICT

"Students are not digital enthusiasts" (Schmid, Goertz, Radomski, Thom, & Behrens, 2017, p. 34). Far more important for most students is the focus on the subject through the teachers and not the media itself. Schmid et al. (2017) also found out that especially teacher training students have the least use and motivation in terms of digital learning.

Similar to the barrier student's lack of knowledge and skills, this barrier could as well overcome by good examples and practices.

ORGANIZATIONAL COMMITMENT OF TEACHING SHOWN BY REWARD AND PROFESSIONAL DEVELOPMENT

Similar to the barrier lack of time, organizational commitment of teaching could be shown by rewarding the extra time higher educational teachers spend on developing TEL settings. Bacow et al. (2012) suggests that the reward should be in reducing other tasks or becoming agrants, since monetary incentives help only conditionally with time-overloaded academic staff.

HETEROGEN AND DEVELOPABLE TECHNICAL INFRASTRUCTURE

Although there are studies that claim that the technical infrastructure is good at German universities (e.g. Schmid et al., 2017), there is surely room for improvements. Hardware and software need to be renewed more often than it is now in order to be uptodate. This means more investment in the technical infrastructure. Bring Your Own Device (BYOD) could be a solution, but the use of private devices in the network of the university involves IT-specific risks (e-teaching.org, 2016).

AVAILABLE AND USED TECHNOLOGY

There is obviously a gap between officially available and used technology. It is difficult for lecturers to use tools that are not officially supported by the university, what also might be related to the General Data Protection Regulation (GDPR).

4.3 HUNGARY

Solutions and strategies to national barriers to TEL

LACK OF TIME

This barrier is found as the most important one by the Hungarian respondents. Too many administrative tasks have been a burden on teachers in all areas of education. Teachers in primary and secondary education and lecturers in higher education spend a lot of time with keeping records of their own work, students' performance, informing all the partners about their achievement. Every action of theirs should be documented, which is really time-consuming. Although preparation for classes, assessment duties are coherent parts of a lecturer's job, time devoted for these tasks is very hard to encounter. There is no regulation on how to count the time a lecturer spends on preparation, assessment, professional development and so on. It is just estimated how much time preparation for one session takes. Certainly, depending on the content and the setting it may differ to a great extent. It is only self-motivation, self-efficacy and self-esteem that make lecturer move towards higher goals and more up-to-date ways of education.

In theory lecturers are entitled to a sabbatical; in practice it is very rarely realized. It could be a period of doing research on TELmethods and tools, results of which could be shared with fellow lecturers at a university.

Unfortunately, doing research, getting familiar with new ways of lecturing, new (TEL) methods and tools are not included in the worksheet of lecturers, although they are expected to carry out these tasks. Most of them do so in their spare time.

Although lack of time is regarded to be the most important barrier, it seems to be not so easy to solve; it is the second most difficult issue on the scale.

1) Time spent on preparation, including using TEL, should be calculated into lecturers' full-time working hours.

2) Face-to-face and online or blended learning settings should have different time allocation being provided. This way lecturers could be motivated to devote the time that is needed to follow and use the most innovative TEL methods and tools.

3) Less bureaucracy in everyday duties of lecturers could spare time they could spend on professional work.

LACK OF HARDWARE AND SOFTWARE

This barrier is considered the second most important one, and the most difficult to solve.

Due to the constant technological improvements, hardware and software quickly needs to be replaced by the most modern innovations. This, of course, requires a lot of investment by the higher education institutions, most of which are hard financial situation. Lecturers are not only aware of this fact, but face this situation in their job. The solutions for this barrier could be:

1) investment by the government into the TEL enhancement of higher education

2) sponsorship, e.g. within dual system education (companies/firms offer field practice for university students) partners of universities could fund purchasing software and hardware that guarantees high standards of education

TEACHERS' LACK OF KNOWLEDGE AND SKILLS

This barrier is a crucial in Hungary, although not the most important one. It is closely connected to the first two barriers: as lecturers have no time for professional development, and there is a lack of tools available for them, they lack the knowledge and skills needed to use TEL methods and tools. It is a vicious circle: without providing time and tools for lecturers, they are unable to have access to the required knowledge to apply new innovations in their practice. Missing the right skills and knowledge, lecturers need more time for self-development (if they have to motivation at all) in this area.

According to the respondents, this barrier is relatively easy to overcome. The solution could be:

1) offering trainings and courses for lecturers in their working hours. In this case, taking part in CPD courses could be made mandatory.

2) providing technological support available at higher institutions during academic hours

3) providing tutorials for lecturers on how to use and apply TEL tools

4) knowledge sharing workshops among lecturers.

STUDENTS' LACK OF KNOWLEDGE, SKILLS AND MOTIVATION

Not surprisingly, this barrier is in the last third of the importance scale, but the easiest to overcome. Students belonging to generation Z are at universities these days. They have a very good command of how to use TEL tools; what they miss is how to apply them sensibly in education. What they also lack is motivation; however, it is lack of motivation in education in general. The lecturers need to have a methodological toolkit when motivate students who are digital natives, who retrieve information or learn in a different way than their lecturers do or used to do. In order to overcome this barrier the following actions could be done:

1) having cross-curricular courses for freshers at universities, where they are familiarized with all the tools that will be used during their studies

2) having tutorials and guidance provided on how to use these tools

3) available assistance in case technological help is needed

LACK OF REWARD AND RECOGNITION

Although it is regarded to be a less important barrier in Hungary, it is among the easy-to-solve ones. Lecturers are used to not getting any bonuses for outstandingly or exceptionally good work, they are mainly self-motivated persons who like meeting challenges and high expectations. Achieving success, meeting these expectations mean rewards for them. Nevertheless, both top-down and bottom-up solutions to overcome this barrier could be found, e.g.:

1) introducing bonuses or incentives for those who take the extra effort that TEL methods require

2) initiating awards/certificates/prizes for innovative lecturers could highlight their extra work for the others

3) make this work visible for others through professional journals, websites; publishing such initiatives make colleagues in the field aware of them, and even motivate them.

LACK OF ORGANISATION SUPPORT

This barrier is regarded as the least important one, however, it is not the easiest to be solved. At John von Neumann University lecturers have developed a blended learning course for in-service teachers, however, it could not be implemented as there is no online platform that could used for such a course. It would require investment first, but there is no support for that. It may seem to be not so important as lecturers lack knowledge, skills to manage such

courses. Still, educational settings as online and blended courses need technological background at higher education institutions. When accrediting in-service teacher training courses, for example, they are required to be partly or completely online. To find solutions for this barrier

1) all higher education institution should have a free online educational platform

2) trainings on their usage should be offered for both lecturers and students.

4.4 NETHERLANDS

Solutions and strategies to national barriers to TEL

The barriers for the implementation of ICT in higher education of the Netherlands, as suggested by hierarchical cluster analysis, are slightly different than those identified in the overall conceptual map including all countries in the project. Instead of six, there are eight thematic clusters showing a more nuanced picture (the technological cluster is divided into two and the statements in the teachers' knowledge and skills group are also distributed into two clusters about learning design). In contrast to the technological barriers, the learning design challenges are considered important but not easy to overcome. The same applies to 'lack of organizational support', which score the highest on importance and relatively low on easy/difficult to overcome this barrier. The most difficult issue to solve is 'learners' lack of relevant competence and motivation' for engaging with technology-enhanced tools and pedagogical methods.

Among the clusters there are some that require external locus of control such as 'lack of time', 'lack of hardware and software', lack of reward and recognition'', and lack of organizational support''. Others, such as 'teachers lack of knowledge and skills, and 'students lack of knowledge, skills and motivation', have internal locus of control nature. Internal locus of control barriers are where the teachers could have direct influence and improve the situation

themselves. This will free up some more resources for dealing with the external locus of control issues. The clusters are separate, not overlapping units, but they are related. A successful action in dealing with one challenge could lead to positive consequences for others.

The leading question when interpreting the results and formulate recommendations is as follows: how can we transform a challenge into an opportunity?

TEACHERS' LACK OF KNOWLEDGE AND SKILLS

The two learning design clusters that are associated to the barrier teachers' lack of knowledge and skills', clearly suggest integration of instructional methods with technologies, a position in line with increasing body of research evidencing that technology alone does not lead to improvement in learning (Clark, 1994; Russell, 2001; WCET, 2019).

The issues with teachers' lack of knowledge and skills' for using ICT effectively in their teaching practice can be dealt with three classical ways: formal training, informal work-place learning and peer tutoring, and performance support systems.

Typically the formal training in using ICT in teaching should be part of the basic qualification training (BKO), which is compulsory for every university teacher in the Netherlands and it is one of the indicators for universities' evaluation. Something similar and useful to be considered is an introduction to a professional training (not necessary related to the BKO approaches) such as applying the University College London's ABC model https://www.ucl.ac.uk/teaching-learning/case-studies/2018/jun/designing-programmes-and-modules-abc-curriculum-design), 8

Learning Events Model (Leclercq & Poumay, 2005) and Ulster's Hybrid learning model (http://addl.ulster.ac.uk/odl/hybridlearningmodel). Informal institutional work-place learning with fellow teachers typically works well but international communities of practice can also be an useful addition to it. Some examples are communities around the Learning Designer tool (https://www.ucl.ac.uk/learning-designer/) and Integrated Learning Design Environment (ILDE) (https://www.upf.edu/web/tide/tools/ilde2/). They provide a place where teachers can

design their courses following evidence-based templates and get peered feedback. Recently, Carnegie Mellon University has launched OpenSimon — a learning design (they called it learning engineering) community (https://www.cmu.edu/news/stories/archives/2019/may/open-simon-toolkit.html). OpenSimon offers a toolkit, consisting of both, educational technology software and learning methods associated to it.

Finally, Performance Support Systems (PSS; Gery, 2002) are embedded into software applications to provide just-in-time, just-enough and just-at-point-of need support to teachers in their use of ICT for educational and training purposes. For example, an online learning platform should include explicitly set of evidence-based learning design guidelines how to structure a course. Probably the most elegant implementation of the ides of PSS is through the technological affordances of a tool (e.g., the suggestions provided by the availability and the sequence of components for creating a course).

STUDENTS' LACK OF KNOWLEDGE, SKILLS AND MOTIVATION

The course's design should take into account the level of knowledge and motivation of students by trying to personalize the content and learning activities. This seems to be the most realistic way, under the control of the teacher, to solve the issue. The course's design should be not only effective and efficient but also enjoyable.

LACK OF ORGANIZATIONAL SUPPORT

What at least can be done in this respect is continuing support for formal teachers' professional development, financial and expert support for the design and development of organizational online learning platform and maintaining and improving the technological infrastructure.

LACK OF TIME

One way of thinking of time not as a threat for successful implementation of ICT in teaching practice is for teachers to perceive it not as something outside, given to or taken from them by someone else, but something they can create themselves. Perceiving the time, either as threat or opportunity, depends also on the type of teacher's motivation – intrinsic or extrinsic. The time should be enough if one is determined and intrinsically motivated to design an effective, efficient and enjoyable course. In addition, the initial investment of time for designing a course using ICT usually pays off.

LACK OF REWARD AND RECOGNITION

Certainly, it would be flattering for everyone to get a recognition, in any form, for the efforts and time to implement innovative TEL approaches. In some organizations, using ICT in teaching practice is considered natural and part of the job description and requirements. However, own satisfaction would even be a stronger factor for further improvement of teaching and professional development.

LACK OF HARDWARE AND SOFTWARE

This is not the biggest concern of the Dutch representatives in this study, although there is always room for improvement. The basic technological infrastructure and tools are in place but what seems to be needed is more support for how to integrate it in the pedagogical practice.

4.5 PORTUGAL

Solutions and strategies to national barriers to TEL

LACK OF RECOGNITION

In the Portuguese context the most important barrier to TEL is lack of reward and recognition. Nonetheless it is relatively easy to solve as the use of TEL in the classroom is neither assessed nor rewarded by the institution or by the peers themselves. As such, solutions are not too difficult to find as the problem would most probably be solved if:

1) the use of TEL was part of the lecturers' overall evaluation. An item should be included in the teachers' assessment grid for the TEL use in the classroom. That way TEL could be more valued in the learning-teaching context;

2) lecturers were assigned less courses so that they could devote more time to TEL;

3) there was a national competition with a prize granted to lecturers who use TEL in the classroom to keep them more motivated;

4) lecturers worked more collaboratively and praised each other efforts when using TEL. People are naturally competitive even though sometimes this condition per se could turn into something negative as peers become rather envious of each other's accomplishments. However, if one highlights the positive side of competition, it should not leave space for envy for each other's work. Instead it should rather work as a stimulus for more collaborative and supportive work among lecturers using TEL in their classes.

LEARNING DESIGN ISSUES

This is the second most important barrier but one of the easiest to solve. We believe this has to do with the fact that if teachers could be furnished with some sort of specific training on ICT they would easily overcome this major constraint. As such, solutions could be as follows:

1. An intensive course on ICT (mainly TEL) for both lecturers and students every year (beginning of the school year)

2. Peer Tutoring sessions among lecturers and students throughout the semester

3. Designing learning is not easy. Usually, the coordinator professor of the department or the scientific area should help the lecturers together to design the learning. But one could create the figure of "DL Buddy"(lecturers with more experience and lecturers with more knowledge in ICT) so that the instructional design was improved and the educational technologies were in fact well used.

LACK OF TIME

This barrier considered not as important as the previous ones, but still the third most important, is seen somehow as very easy to solve. The only solution that we believe would immediately overcome this barrier is **the reduction in the number of teaching hours in accordance with the European average**. Normally, at the IPB and the other Polytechnic Institutes in Portugal, the normal number of teaching hours assigned to a senior lecturer per year is 12 hours a week. This number leaves very little time for other required and mandatory tasks such as research (e.g. TEL methods and tools in order to apply them in class) and organizational work, which are part of the teaching staff assessment.

TEACHERS' KNOWLEDGE AND SKILLS IN ICT

In order to teach effectively, based on TEL, lecturers should have a good command of ICT. However, this barrier, seen the fourth most important, is also the most difficult to solve. In our viewpoint, and considering the Portuguese context, the higher education institutions should:

1) promote the use of TEL by carrying out training sessions and workshops;

2) implement curricular guidelines for the use of TEL in the higher education context;

3) Create peer tutoring groups in which the lecturers who have a better command (and feel more confident with) of ICT could guide the other colleagues who have less knowledge and skills in this domain.

MORE WORK, LITTLE SUPPORT

This barrier is at the same level of importance as teachers' knowledge and skills in using ICT. Even though considered less important, it is nonetheless not too difficult to solve. If the institution does not provide the lecturers with the right support regarding the use of TEL, then the teaching staff cannot do much about implementing this innovative approach in class. Therefore, solutions to address this problem could be:

1) Actively promote ICT formats like blended learning and online learning. In Portugal, the higher education accreditation system should grant the approval of blended learning or online learning to other higher education institutions apart from Open University that normally provides this teaching mode.

2) Reduce the number of teaching hours to the lecturers who are in fact using TEL tools in their classes

LACK OF HARDWARE AND SOFTWARE

This barrier is considered very important, but one of the most difficult to solve.

Due to the constant technological improvements, hardware and software quickly seem to be obsolete and should be replaced with more recent ones. This, of course, requires more investment by the higher education institutions, which is already a barrier itself.

Solutions (grounded on coordinated actions among the different stakeholders involved: Higher Education Institutions, Ministry of Science, Higher Education and Technology, secondary and basic schools):

1. Hardware and software reuse policies. Every two years, higher education institutions should make updates. The replaced material would go to secondary and basic schools that could reutilize the technological devices no longer used in other institutions. This, of course, would be sustained on a non-discriminatory approach but rather on a cooperative attitude in which everyone, in a concerted way, would profit (win-win proposal).

2. Improve the already existing governmental policies about replacing commercial software by open source software.

LEARNERS AS A FOCUS FOR TEACHING WITH ICT

Focus on learners regarding their knowledge, skills and motivation on ICT skills seems to be quite difficult to solve, despite the fact that it is considered the least important barrier. In order to overcome this barrier, the following solutions and strategies could be carried out:

1) Stimulate students' motivation by introducing and practising innovative and meaningful approaches so that students could identify themselves with the course or topics studied, namely: co-creation, flipped classroom, collaborative work. That way TEL tools and methods could gradually be introduced (and explained to students) into the classroom.

2) Assign the students with more autonomous and responsible tasks. Make the students feel they are also part of the co-creative work as everyone is important and should hence be involved in the teaching-learning process.

3) Create tutoring groups among students in which the students who have a better command (and feel more confident with) of ICT could guide the other students who have less knowledge and skills in this domain.

4) Teachers should know exactly what to do in class when using TEL, that is, they should have a good lesson plan so that students are adequately guided and given accurate information and instructions regarding the different steps they need to take when dealing with TEL tools, for example.

4.6 SPAIN

Solutions and strategies to national barriers to TEL

LACK OF REWARD AND RECOGNITION

In the Complutense University of Madrid, as in the other public universities in Spain, the main problem is personal motivation for lack of recognition and / or financial compensation or some other type.

The professors who dominate the TEL and use them in their classes have spent a lot of personal time learning those tools and developing teaching methods with them to motivate the students. They have not obtained any compensation or recognition for it, while the faculty that has not worried about it, has not invested time or effort in this matter, obtaining the same result in terms of recognition or financial compensation.

The problem would not have much difficulty in solving, since it is fundamentally economic, although this problem, in a public university, does become a dead end.

However, some type of recognition could be established on the basis of teaching load, for example:

a) Teachers who present new tools, along with the way of employment in the classroom, can have up to 3 recognized direct teaching credits for the next course.

b) Training seminars for interested teachers can be organized, given by teachers who have used tools in the classroom and have positive experiences in their use. These seminars could be an economic incentive for the professors.

c) Establish an official recognition as an investigation if a complete article with method and different application tools is presented to obtain certain learning results.

LACK OF HARDWARE AND SOFTWARE

The problem of lack of hardware, and also of software, is as important as the first one described, since the computers of the offices are shared by several professors and, for the most part, they are quite old-fashioned.

On the other hand, the system of assigning IP address to each computer, as well as the antivirus, are very strict and do not allow flexibility to install programs or perform tests with innovative applications. Much more flexibility is needed to be able to simulate and subject the equipment to the necessary tests to ensure that the innovations are reliable and that they work for the purpose that has been set.

a) This problem would also be very easy to solve, because it is again an economic issue. But being a public university (with many faculties), the budget is diluted, and, in the end, it does not reach for the expansion and renewal of equipment that would be necessary.

b) Teachers tend to have better personal equipment at home than those offered by the university. Therefore, another inexpensive solution could be to economically incentivize the faculty that decides to investigate on their own -with their team and their time- in this field and compensate them for results, either with a premium, or with modern and powerful equipment.

LACK OF ORGANISATION SUPPORT

The lack of support from the institution is the main cause of the two previous barriers.

Actually, it is not that it does not support but that it is not enough. The fundamental problem is economic, and the budget depends, to a large extent, on the university's own resources. In recent years, this situation has not been very propitious and the economic incentive to teachers for these issues has not been able to raise. However, the recognition of this research work could be considered. Thus:

a) The University could encourage the teaching staff to investigate in this field so that it provides concrete results of application in the classroom. This could be achieved on the basis of a certificate that would serve as an accredited research time.

b) Incentive based on the reduction of the workload in the following course.

c) Development of training courses for teachers in these results obtained, obtaining financial compensation.

LACK OF TIME

All the previous barriers are related to this one. It is a kind of chain in which the contiguous links are represented by these barriers. They are all very close, like the links in the chain.

The lack of time is a consequence, to a large extent, of the previous barriers, although it is also due to a teaching load in the limit of the legally permitted. It is clear that a charge to the maximum allowed is, in itself, a disincentive for teachers to devote their time to research in the field of TEL Tools.

Nor should the solution to this problem be too complicated:

a) In order to motivate the faculty that wishes to investigate in this field, a first measure would be to reduce the teaching load in some proportion.

b) The hiring of teachers from aides' doctors, fellows, teacher's emeritus ... who can take care of some of the hours of reduction of the research faculty in this field, would help a lot without incurring unaffordable expenses.

c) The conversion of some face-to-face classes in "online" could also represent a time decongestion for the teacher willing to join several groups and perform some kind of this type. Thus, reduction objectives could be achieved without the need to hire new teachers.

TEACHERS' LACK OF KNOWLEDGE AND SKILLS

Teachers at the UCM usually have an acceptable level in ICT. This means, as a minimum, advanced user (according to Microsoft). It does not seem to be a very important problem in our University, although training must be a constant in the ICT field, since the advances are continuous, and it is necessary to recycle continuously.

The predisposition of teachers to perform training outside working hours is not optimal, but if they are given facilities, experience shows that they do collaborate to a large extent. Therefore, the proposed terms would be the following:

a) Design online training courses that are absolutely didactic and interactive. Material in short videos very well oriented to self-learning. Clear, practical and available to the faculty at all times, from the subscription-free-to the course.

b) The courses should be able to follow on the mobile with ease, as well as on any other device.

STUDENTS' LACK OF KNOWLEDGE, SKILLS, AND MOTIVATION

The students of the UCM present, mainly, the level of an advanced user, like the professor of the UCM. This allows them to immediately assimilate any new tool that is used in class to work on some content.

The students, in general, welcome any initiative to use TEL Tools, and they learn without problems its handling and other possible applications. This represents a good motivation.

In the case that they are missing, it is easy to strengthen it by solving this barrier, which is one of the easiest to overcome:

a) Students are open to working with TEL Tools naturally since those who fill the classrooms at this time are already of the generation of the new millennium. They all have powerful mobile phones and use them continuously, so they do not find it strange to use any TEL Tool.

b) The tools used must represent a greater facility than the conventional to understand or work the contents of the subject. If they are new tools, unknown to them but effective in learning, so much the better, they value them much more.

c) There are hundreds of application repositories around the world. Many of them are developed with free software and can be used without any licensing problems. A specialized portal on it is www.sourceforge.org

d) The teacher can (and should) promote the debate on the tools and that the students are those who propose their tools to work on contents. On many occasions, it is surprising to see the great knowledge they have of TEL Tools and how sharing that knowledge and explaining them to others, including the teacher, motivates them enormously.

REFERENCES

Clark, R. (1994). Media will never influence learning. EDUCATIONAL TECHNOLOGY, RESEARCH AND DEVELOPMENT, 42(2), 21-29.

E-LEARNING HANDBOOK. BEST PRACTICES, STRATEGIES, AND CASE STUDIES FOR AN EMERGING FIELD. (pp.24–37). New York, NY: McGraw-Hill.

Gery, G. (2002) 'Performance support – driving change', in A. Rossett (Ed.), THE ASTD

Jokiaho, A., May, B., Specht, M., & Stoyanov, S. (2018). Barriers to using E Learning in an Advanced Way. INTERNATIONAL JOURNAL OF ADVANCED CORPORATE LEARNING (IJAC), 11(1), 17-22.

Leclercq, D. & Poumay, M. (2005). The 8 Learning Events Model and its principles. Release 2005-1. LabSET. University of Liège retrieved from http://www.labset.net/media/prod/8LEM.pdf

Russell, T. (2001). THE NO SIGNIFICANT DIFFERENCE PHENOMENON: A COMPARATIVE RESEARCH ANNOTATED BIBLIOGRAPHY ON TECHNOLOGY FOR DISTANCE EDUCATION (5TH ED.). Montgomery, AL: IDECC.

WCET (2019). NON-SIGNIFICANT DIFFERENCE PHENOMENON. Retrieved May 10, 2019 from http://www.nosignificantdifference.org/